

## Explanations of Silvicultural Systems

### Shortleaf pine restoration

Several areas are being considered for establishing shortleaf pine, including areas where the species occurred historically or where site conditions allow for good growth. It is likely that shortleaf pine occurred here in stands mixed with hardwoods. It is believed that shortleaf occurred mainly on rounded ridges with fairly deep sandy, loamy soils which were neither highly acidic or highly alkaline. The objective is to establish viable, “self-perpetuating” communities of shortleaf pine in 36 locations within the project area. These will not be extensive pure stands of shortleaf pine, but rather mixed hardwood and shortleaf pine stands with other pine species such as Table Mountain pine and pitch pine.

- 1) In areas proposed areas, the stand would be variably thinned to a residual stocking of 15 to 60 ft<sup>2</sup>. Much of the area would be reduced to 15 to 30 ft<sup>2</sup>, in order provide enough sunlight for the successful establishment.
- 2) Clusters of shortleaf pine would be established in “open” areas. Approximately **6 to 12** clusters of 40 shortleaf pine seedlings would be established per acre. These locations would be tagged and located using GPS. Spacing would be fairly tight (4 to 6’) to allow SLP to quickly occupy the site. A goal would be 5 to 8 trees in each cluster reaching maturity. That would result in about **40 to 70** mature SLP trees per acre in the future “arranged” in groups. This is the condition in which we observe remnants in the field today for the most part.
- 3) Mechanical methods and herbicides would likely be used during site preparation before planting to control competing vegetation. Sprouting hardwood trees and other vegetation can pose serious problems in artificial establishment of short leaf (Barnett, 1986). Planted areas would likely require a “release” from competing vegetation late in the second growing season or multiple releases depending on site quality.
- 4) Once established the SLP should grow quickly. It may be necessary to do some early thinning (pre-commercial with brush saws) if survival is high, to avoid stagnation. This is typically done at 5 to 8 years of age, but not before the trees are at least 10 to 12 feet in height. No more than one-half of the trees should be removed during such an operation.
- 5) In many areas, a prescribed burning regime would be established to maintain open stand conditions and promote natural regeneration of shortleaf pine. Burning reduces the forest floor (organic layer) and in some areas exposes mineral soil which is important for germination of pine seed.
- 6) The first burn will occur after the SLP becomes fire resistant, about 5-8 years of age.
- 7) Shortleaf pine seedlings form a natural “crook” at the soil surface which allows for it to re-sprout after being top-killed (for 8 to 12 years)(Mattoon, 1915). In the crook, there are several dormant buds which are protected from fire. If some of the planted saplings are killed after the first Rx burn, they would likely vigorously re-sprout.
- 8) Periodic fire would be variable and occur at a return interval of 6 to 12 years.

- 9) The use of fire is expected to achieve natural regeneration of pine in years to come, creating multiple age classes. As the pines mature, we expect to see trees become established in surrounding areas.
- 10) Increases in native grasses is expected as a result of Rx fires. Supplementing grasses with seeding operations may be necessary.
- 11) Established clusters of SLP would be monitored closely in the first five years, in case additional actions are needed to insure survival.

**Long term management** of mixed hardwood and shortleaf pine stands will require a strategy of stocking manipulation (timber harvesting), prescribed fire and scarification of to insure the reproduction of the shortleaf pine component in these stands. Good seed crops of shortleaf pine are not reliable and are difficult to predict. One strategy in the literature has suggested and that it is possible to “accumulate” shortleaf seedlings and saplings in the understory through frequent fire. Shortleaf re-sprouts readily after being top-killed by fire, and together with new seedlings that germinate after fire, a consistent pool of SLP seedlings and saplings would be present in the understory. This would allow SLP in the understory to be responsive to an opening in the canopy (Guldin, 2007). Without fire, in the midst of heavy understory and mid-story vegetation, the understory would be relatively dark and shortleaf pine seedlings (if they germinate at all) would only survive for a short period of time.

The goal will be to manage these stands through thinning and fire to create conditions needed for a perpetuation of the mixed hardwood and shortleaf pine stands types. For example, periodic thinnings occurring every 15 to 20 years would be necessary to open holes in the canopy so that new cohorts of both shortleaf pine and hardwoods can be established. As discussed periodic fire will be important to create adequate seed germination beds. This should result in numerous age classes and diverse stand structure over time.

### Coppice with Reserves

The objective of these operations would be to create new tree stands, regenerating oak and other species important for wildlife. Creating a diversity of age classes is important to maintaining good mast (acorns, hickory nuts, etc.) production. Meanwhile, this action also creates early successional habitat (ESH) which is an important desired condition in the Forest Plan.

- 1) Final unit acreages will not exceed 40 acres per unit.
- 2) Coppice with Reserves treatments would leave a partial stand of approximately 15 - 30 ft<sup>2</sup> of basal area per acre (approximately 20 to 35 variably spaced trees per acre, including clumps).
- 3) At this stocking level, there will be adequate sunlight to achieve a favorable regeneration response. This will result in the creation of a two-aged stand.

- 4) At least one third of all leave trees shall be left in clumps of ten or more trees. Other leave trees will be designated as scattered singles or doubles. Species preferred for leave trees include long lived species such as white oak, chestnut oak and hickory species, as well as other trees valuable to wildlife such as black gum, and serviceberry. Yellow pine species such as pitch pine, Table Mountain Pine and shortleaf pine are good choices for leave trees as well, especially in areas where these species are well suited. Species such as scarlet oak, sweet birch, red maple, and striped maple are not left as leave trees.
- 5) Regeneration of oak of productive sites can be challenging. Various cultural treatments before and after harvesting may be implemented to improve regeneration of oak and other species important for wildlife by controlling competition. Some possible treatments include mechanical site preparation, site preparation with chemicals, pre-harvest injections (PHI), and forest stand improvement (FSI). We find that in most cases that this work is needed on sites which are more productive (greater than 65' site index for upland oak). As the site indices go up so does the need for cultural treatments to assure at least 40 % oak stocking in the future stand. On some of the more challenging sites an oak shelter-wood would be implemented by killing the mid-story and deferring the harvest for 10 to 15 years to allow oak seedlings to develop into large saplings. This allows the oak to better compete with other species after the final harvest.

### Variable Thinning

Based on the site specific objectives variable thinning will reduce stand basal stocking by 40 to 75%. The objective is create "open" canopy conditions over a large area to encourage the growth and development of understory vegetation such as grasses, forbs, and shrubs. Residual stocking would vary across units to create diverse conditions, including maintaining patches of closed canopy forest.

- 1) Leave trees would generally be codominant and dominant trees and meet one of three criteria; **a)** A long lived species such as white oak, chestnut oak, hickory species among others, **d)** Other species important for wildlife (black gum, serviceberry, dogwood and other fruit producers), **e)** Trees which have pre-existing dens, or will likely provide cavity nesting opportunities in the future.
- 2) Some retained trees may be deadened by double girdling or chemical injections to create more snags and down large woody debris habitat.
- 3) A combination treatment of thinning and periodic burning is desired in most of these stands in order to maintain open canopy conditions for some period of time. Stands thinned heavily (residual basal area stocking less than 50 ft<sup>2</sup> per acre) will require periodic burning to arrest the regeneration response in the understory. In the absence of fire, partial stand regeneration will occur, and would likely lead to stands with an unacceptable amount of shade tolerant trees which are not fire adapted, replacing oak and other important species in the stand.
- 4) In stands that are burned, the fire return frequency will likely vary from 4 to 12 years based on the site specific Rx.

- 5) In many cases stands which cannot be burned will not be thinned below 55 ft<sup>2</sup> per acre in most cases due to reasons explained above. Thinning to this level will still leave the stand fully occupied, and not triggering a substantial regeneration response.
- 6) Maintaining a diversity of age classes in thinned stands is also an objective where conditions exist. This is an important characteristic of resilient forest stands.
- 7) Grassy area enhancement will occur in several locations and will require reducing the number of trees by one half or more. This could be done commercially or by non-commercial means in some areas, including herbicides. Scarification and supplemental seeding of native grasses may occur.

#### Uneven-aged Stand Management

In at least one stand within the project, Northern Hardwoods dominate. The stand is located near the headwaters of the German River and is dominated by sugar maple. The stand type is uncommon in this area.

- 1) The stand will be managed to maintain multiple age classes mainly by regulating the stocking of three broad basal size classes; a) 5 to 10", b) 11 to 18" and c) 19" and greater.
- 2) Entries would occur every 20 – 25 years to maintain desired stocking levels among the three size classes.

#### Forest Stand Improvement

In designated areas approximately 15 to 30 trees per acre would be released. Desired trees would be long-lived and important to wildlife. Desired species include white oak, black oak, N. red oak, chestnut oak, all hickory species, and others. In many cases FSI is performed when the stand is 10 to 18 years old. Some of the stands that are identified are older than that, but would still benefit from limited release work. An example would be to inject and kill all red maple and sweet birch over 6" in diameter to improve species composition.